Duane. (A.)

Some New Tests for Insufficiencies of the Ocular Muscles,

Together with a System of Abbreviations suitable for Note-Taking.

BY

ALEXANDER DUANE, M. D.,

NEW BRIGHTON, N. Y.

REPRINTED FROM

The New York Medical Journal

for August 3, 1889.

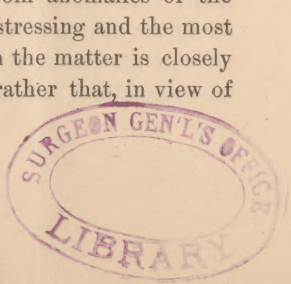
Reprinted from the New York Medical Journal
for August 3, 1889.

SOME NEW TESTS FOR INSUFFICIENCIES OF THE OCULAR MUSCLES,

TOGETHER WITH A SYSTEM OF ABBREVIATIONS SUITABLE FOR NOTE-TAKING.

By ALEXANDER DUANE, M. D.,
NEW BRIGHTON, N. Y.

The important part played in the causation of all sorts of nervous diseases by anomalies of the oculo-motor apparatus is becoming daily more and more apparent. Since the epoch-making labors of Dr. George T. Stevens, the proposition that disorders of the muscular mechanism of the eye are a more potent and constant cause of functional nervous affections than any other source of reflex irritation may be considered as established on a firm foundation. Epilepsy, chorea, hysteria, neuralgia, and those aggregations of symptoms which have been vaguely lumped together under the names of neurasthenia, spinal irritation, etc.—in a word, the great concourse of nervous diseases which arise without the production of lesions of the nervous substance—are to a great extent dependent upon eye-strain, and, of the varieties of eye-strain, those which spring from anomalies of the muscular apparatus are the most distressing and the most severe. Nor is this wonderful when the matter is closely considered. Indeed, the wonder is rather that, in view of



the obvious facts of the case, anomalies of this sort should hitherto have received such scant attention. It is true that there are many other sources of reflex irritation, all more or less distressing and all capable of producing serious nervous symptoms. The nasal, the oral, and the genital apparatus may each be the seat of some affection capable of giving rise by its presence to asthma, epilepsy, neuralgia, etc. The unfortunate who suffers from hypermetropia or astigmatism is still more liable to reflex troubles, for he is compelled during every minute of his waking existence to exert great and most tormenting strain so as to see with a distinctness sufficient for his daily needs. But he who has a faulty direction of the visual axes or a relative weakness of any of the ocular muscles is in a still worse case. A man, for example, who has a hyperphoria of two or three degrees must, during every minute that he uses his eyes, exert an enormous force, not merely to see distinctly, but even to see at all. Let any one who wishes to realize what a strain this means take a two-degree prism, place it base down before one of his eyes, and then try to read. The sense of confusion will soon become so maddening that few will venture to prolong the experiment beyond ten minutes. And yet this strain is not as great as many of us have to undergo during the whole time that our eyes are open. No one who has not himself suffered from this burden can realize how intolerable it is, how it dissipates the vital forces, how it renders inert and inactive a man of otherwise sound constitution and good mental capacity.

From the frequency of these sources of irritation and the great part they play in the causation of nervous troubles, their consideration is no longer confined to the ophthalmic or to the neurological specialist, but interests all members of the profession alike. It is true that for their accurate determination and their cure the most painstaking and

delicate manipulation is required, such as requires the aid of a special apparatus and a special professional training which the oculist alone can supply. But their recognition does not always or often imply the need of apparatus or of particular skill, and the tests which establish the existence of heterophoria are no more mysterious or complex than the tests of the reflexes in determining the presence of locomotor ataxia.

The object of the present article is to exhibit briefly the methods and limitations of certain simple tests which do not require instruments, and which therefore can be employed by those who do not possess or who have not the skill to use an oculist's armamentarium. The usefulness of such tests is not, however, confined to this application of them. In all cases they will be found serviceable as adjuncts to the instrumental tests, serving to check and confirm the latter, and in some cases are available where other tests fail or are uncertain.

It may be well, before entering into a description of these tests, to set clearly before our minds what we intend to determine by their aid. The problem for solution—that of the condition of the oculo-motor apparatus—is one both of statics and of dynamics; in other words, what we wish to ascertain is, first, the normal balance and the individual tendencies of the different muscles when the eye is in a state of repose, and the muscles themselves are placed as far as possible in a condition of equilibrium; and, second, the relative power of the individual muscles when set in action, and the resulting capacity of the eye for motion in different directions. Defects in the former regard—that is, in the static condition of the eye—constitute the various forms of strabismus and of heterophoria. Without going into a description of the latter condition, which has already been amply considered in the works of Dr. Stevens, we may say in-

brief that one or more of the following conditions may exist: Esophoria, or a tendency of the visual axes inward; exophoria, or a tendency of the visual axes outward; and hyperphoria, or a tendency to vertical divergence of the axes. The determination of the direction and the amount of these deviations requires the eye to be placed in a state of complete repose, and, as this condition of absolute equilibrium can never be perfectly attained, repeated and carefully conducted examinations must be made in order to approximate as nearly as can be to the ideal state and to eliminate accidental errors. Defects in the dynamic condition of the eye are constituted by such insufficiencies or such excessive actions of the ocular muscles as cause one or both eyes to perform either too greatly or to too slight a degree the movements of abduction, adduction, and sursumduction. These defects usually coexist with heterophoria, but do not necessarily do so, and their determination requires equally careful and repeated testings. In this case, moreover, the examination can also be made to do service as an exercise for the weaker muscles.

The whole problem, however, whether viewed from the side of statics or dynamics, resolves itself into this query? How far and in what sense do the visual axes deviate or tend to deviate from parallelism both in a state of repose and during the various associated movements of the eyes: With the proposition stated in these terms, it is easy to see that the perfectly acting eye, whether at rest or in motion, will be so directed that its visual axis * is parallel with that

* The visual axis in some very rare cases seems to be widely different from the optical axis. Thus, in one case in which there was well-marked deviation of the eyes out, both behind the screen and also when any attempt was made at fixation, there were homonymous diplopia and an esophoria of twelve degrees or more. Such a condition can scarcely be explained on any other hypothesis than that the region of

of its fellow, while the heterophoric eye will in some position exhibit a deviation of the axis, to overcome which demands an extra muscular effort and a consequent overstrain of nervous energy.

By keeping this preliminary proposition in mind, the consideration of the tests themselves becomes greatly simplified. Like the problem which they are designed to solve, the tests themselves may be either static or dynamic. Of the former kind, which are concerned with the tendency to deviation exhibited by the eyes when in a state of rest, the most obvious—*i. e.*, that afforded by the mere inspection of the eye—is rarely of any service, because the manifest variations constituting heterophoria are often so slight as to be unrecognizable by this means, and also because, when a variation is appreciable, it is often impossible to tell its direction from inspection alone. This is especially the case in hyperphoria, in which the tilting of one eye above the other is often masked by simulated turning in or out (apparent esophoria or exophoria). Corresponding to this rough objective test is the more delicate subjective one furnished by the patient's perception of diplopia when the eyes are in a position of equilibrium—*i. e.*, when the head is in the normal erect position and the visual axes are directed straight forward at an object twenty feet or more distant.* This diplopia is, of course, usually recognized only when the red glass is employed to differentiate the images; and it is quite important to distinguish the cases in which diplopia occurs spontaneously (or can be produced

most distinct vision was not situated at the normal position of the macula, but at a point considerably external to the latter, so that even when the eyes deviated outward the visual axes were still convergent.

* Or more. In testing for muscular anomalies, twenty feet do not constitute infinite distance. This is seen especially in testing the abduction, which at a distance of twenty feet will often be found to be quite a little greater than at fifty feet and less than at ten feet.

spontaneously by the patient's will *) and those in which it is apparent only upon using the red glass. The diplopia may be lateral (being then either homonymous or crossed) or vertical, and in the latter case may be designated as right or left according as the right or left image is below (indicating that the right or left eye is the higher). If prisms are available, the amount of diplopia can be measured by the degree of the prism which, placed before either eye, causes fusion of the images.

The second set of tests for determining the static condition of the ocular muscles is afforded by the use of the screen. This procedure—mentioned by Landolt ("Examination of the Eyes"), but only in connection with the accommodative movements of the eye, *i. e.*, with the visual axes converging, and employed by Stevens and others when the visual axes are in parallelism—is conducted by placing a screen (such as a card or the hand) before one eye and, while the other eye remains fixed upon one object, observing the direction which the covered eye tends to assume. By shifting the screen from one eye to the other, the eyes being steadily directed toward one object, the eye which is uncovered will, in order to see the object, move in a direction contrary to that which it had assumed behind the screen. For example, with both eyes looking straight forward at a candle twenty feet distant, and with the card placed alternately before either eye, the left eye on being uncovered moves down. The inference is that behind the

* It may be here remarked that in testing the static condition of the eyes, voluntarily produced diplopia does not afford such trustworthy indications as diplopia spontaneously existing. The very act of separating the images by voluntary effort implies a muscular strain which disturbs the relations of the eyes, and which may alter the direction of their axes in a vertical as well as in a horizontal plane. I have once or twice observed this in practice.

screen it was standing higher than its fellow—*i. e.*, there is a condition of left hyperphoria.

The screen test as thus performed is a very useful adjunct to the prismatic tests for heterophoria, and if the latter exceeds in amount a couple of degrees, the movement of the eye on shifting the screen is usually quite perceptible. On the other hand, when the manifest heterophoria is less than two degrees, it is difficult to detect any deviation behind the screen. When, therefore, this deviation exists, it is a strong confirmatory evidence of heterophoria; but its absencce is not conclusive as to the non-existence of the latter condition, and in some cases—*e. g.*, in such a one as that mentioned in a preceding foot-note—even its presence is not absolute proof either of the presence or of the character of the pathological condition. It can not, therefore, be implicitly relied upon unless checked and confirmed by other methods of examination, and yet it is of great value and should always be called into requisition in testing for muscular insufficiencies.

A modification of the screen test—which, as giving subjective instead of objective indications of the presence of deviation, bears the same relation to the ordinary screen test that the detection of diplopia by the red glass does to the estimation of heterophoria by the mere inspection of the eyes—is the *parallax* test. This, as far as I know, has not yet been employed in ocular examination; I am therefore inclined to regard it as original with myself. It consists in shifting the screen from one eye to the other and making the patient observe if the image moves, and, if so, in what direction. If the patient is in the standard position—head and shoulders erect and eyes looking straight forward at an object twenty feet or more distant—there should, if orthophoria exists, be no movement of the image when the screen is shifted. If, accordingly, under these

conditions and after repeated trials, the object observed appears to the patient to always occupy the same position, it may be assumed that, as far as this test goes, there is no tendency to deviation from parallelism of the visual axis. If, on the contrary, the image appears to shift its position with the alternate withdrawal and replacement of the screen, there exists what may be appropriately denominated a parallax, and it may be taken for granted that heterophoria exists. The parallax is in reality only a form of diplopia, being produced, as diplopia is, by lack of parallelism of the visual axes; and, like diplopia, it may be homonymous, heteronymous, or vertical. In other words, if, when the left eye is uncovered and the right concealed, the patient sees the test object—*e. g.*, a candle—moved to the left, the parallax is homonymous and the visual axes tend to cross; if the candle-image moves to the right, the parallax is heteronymous (or crossed) and the visual axes diverge; if it moves down, there is vertical parallax (left parallax), indicative of left hyperphoria; if it moves up, there is right (vertical) parallax, indicative of right hyperphoria. Of course, we may have both lateral and vertical parallax combined, in which case both a lateral and a vertical movement of the image will be observed.

The test so performed is exceedingly simple, and yet from a somewhat extensive trial of it, I am led to believe that it is a very delicate one. The degree of shifting of the images is a measure, approximately at least, of the amount of heterophoria, and, if it is desired to measure the latter precisely, this can be done by placing prisms before the eyes until the images no longer change their position with the movements of the screen. The strength and axial direction of the prisms will obviously indicate the amount and character of the correction to be employed for the heterophoria. Thus, suppose that the image moves down

when the right eye is uncovered, a prism of one degree is placed, base down, before the right eye, thus elevating the image. The shifting of the screen still shows a parallax, but now in the opposite sense—that is, the left image moves down. The prism is now revolved until its apex points to 30°, at which point no vertical movement is observed on displacement of the screen. The test therefore indicates a right hyperphoria of about $\frac{1}{2}°$, or, as I prefer to put it, there is a right parallax of $\frac{1}{2}°$. Differences in the level of the eyes of one tenth to one fifth of a degree can usually be detected by the parallax test, and it is thus quite as delicate as the ordinary test for hyperphoria (*i. e.*, the production of artificial diplopia by the use of strong prisms with their bases directed in, and the estimation by the patient of the difference of level existing between the two images), and it has the advantage that one source of error—namely, the failure to perfectly adjust the diverging prisms—is eliminated. Moreover, in all tests performed upon the eyes, the nearer we approximate to the natural state the better; and I think there can be no question but that the use of prisms to produce diplopia introduces an artificial condition, and so tends to disturb the natural relations of the eye and to produce more or less involuntary muscular effort, when what we desire is the completest muscular relaxation possible. Hence I have lately been in the habit of regularly employing, first, the screen and parallax tests, which introduce conditions least removed from the natural; then using prisms to make the ordinary examination for hyperphoria and for lateral insufficiency; and, last of all, testing the dynamic capacity of the eye by finding the abduction, adduction, etc. This last examination, by calling into play the different recti, tends to temporarily destroy the balance of these muscles, and should therefore be always deferred till the static tests, which presuppose the

recti to be as far as possible in equilibrium, have been performed.

Another example of the usefulness of the parallax test in examining for hyperphoria is found in those cases in which we have had the patient wear a trial prism in order to detect the amount of this condition. If, for example, we have suspected right hyperphoria, and, in order to test the matter, have had the patient wear a prism of 1°, base down, before the right eye for a day or so, and, on coming back, he has shown, with his prismatic glasses on, no parallax or ever so slight a tendency to left parallax, we infer that the glass is overcorrecting, and that our suspicions were probably erroneous. For, after wearing such a glass, a patient who really has right hyperphoria of any appreciable amount would show more than 1° of it, and hence would, with his glasses on, exhibit a right parallax. I have found this application of the parallax test very useful, and by its aid have succeeded in measuring very precisely even minute degrees of hyperphoria.

In examining for lateral insufficiency, the parallax test is equally useful and equally delicate, an exophoria or an esophoria of one degree or more being usually evidenced by a distinct movement of the images from side to side. The amount of lateral deviation may be quite accurately measured by the degree of excursion of the images, or, if desired, by the strength of the prism which, placed base in or out, abrogates the parallax.

The parallax test is further of service when we wish to ascertain whether a glass, designed for the correction of refractive errors only, exerts a prismatic effect. For instance, suppose that a patient with hypermetropia shows, when his refractive error is corrected by properly centered lenses set in a trial-frame, no parallax, but that, when he puts on spectacles made for him by the optician, a distinct parallax

is obtained, it is evident that the spectacle-glasses are either improperly adjusted or, from some defect in construction, contain a prismatic element. They should now be adjusted upon the face till the parallax disappears or becomes as small as possible, when the error due to the former cause will have been eliminated. Then any error due to improper construction can be measured by noting the strength and direction of the prism which, placed before the glasses, causes the residual parallax to disappear.

The results of the parallax and of the screen tests should always be congruous; and even in such a rare case as that before mentioned—in which, with deviation of the eye outward, there were homonymous diplopia and an esophoria of 12° or more—the parallax was necessarily heteronymous.

All the tests which have been hitherto described are arranged for determining the static condition of the eyes. The dynamic tests, or those which aim to determine the power of the different muscles, are various. Besides the estimation of the abduction, adduction, and sursumduction, by placing prisms before the eyes with the bases in, out, up, and down, the diplopia produced by which the patient is required to overcome, there is one rough test that I have lately employed with, I think, considerable advantage in estimating the excursion of the eyes inward and outward. It is analogous to the expedient ordinarily employed in examining for weakness of either of the lateral recti—an expedient which consists in moving before the patient's eyes a small object as a pen-point or the finger and watching the behavior of the eyeballs as they follow the latter from side to side. In the modified test, which, for want of a better name, I call the *excursion test*, the object looked upon is stationary and twenty feet or more distant, and the patient's head is slowly turned from side to side while his eyes re-

main fixed upon the object. The test is both objective and subjective, the physician observing any tendency to deviation which the eyes may exhibit during their excursion, and at the same time requiring the patient to notice any diplopia or other subjective evidence of heterophoria. For the latter purpose, the use of the red glass placed before either eye is almost always necessary. Starting with the standard position, which, borrowing military phraseology, may be designated as "eyes front," the head is successively moved to the right (giving the position of "eyes left") and to the left (giving the position of "eyes right"), and in each position the presence and direction of any obvious deviation of the eye, of diplopia, and of parallax are noted. A case from actual practice will illustrate the applicability of the method. In a patient, previously operated upon by partial tenotomies of both internal and external recti, there were in the "eyes-front" position an esophoria of 1° combined with an abducting power of only 3° and an adducting power of 50°, a tendency to spontaneous homonymous diplopia, and a homonymous parallax. In the "eyes-right" position the homonymous diplopia and parallax were still more marked, increasing progressively till the former could not be overcome by voluntary effort. In the "eyes-left" position the conditions were reversed, the homonymous diplopia and parallax diminishing to zero and then becoming heteronymous. In other words, as the eyes moved in association to the right, there was a progressively increasing tendency to convergence, and, as they moved to the left, an increasing tendency to divergence of the visual axes. Moreover, the position of equilibrium for the eyes was not in the position of "eyes front," but in a slightly "eyes-left" direction. To explain these phenomena, any one of the following hypotheses may be advanced:

1. The movements of the left eye are excessive both in

abduction and adduction, without impairment of the functions of the muscles of the right eye. This hypothesis is scarcely tenable, especially in view of the restricted adduction (only 3° instead of the normal 8°).

2. The movements of the right eye are restricted in both abduction and adduction.

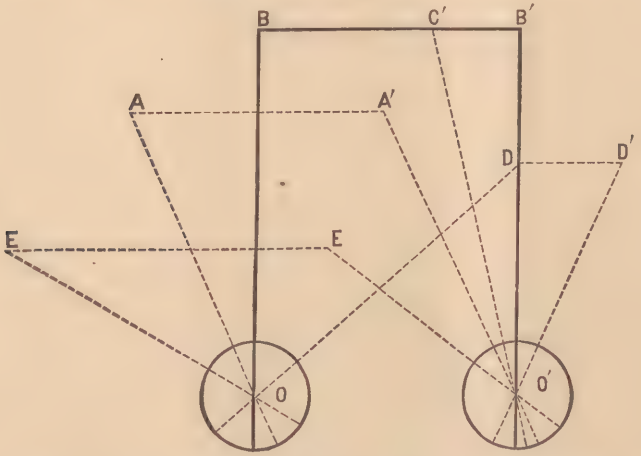
3. A combination of restriction of movement of the right eye with excessive latitude of motion of the left eye exists.

4. There is a tendency to associated deviation of both eyes to the left, together with excessive abduction of the left eye and restricted abduction of the right, the adduction of the latter being normal or more probably diminished.*

This last hypothesis seems most probable. It is indicated in the accompanying figure, in which, when the eyes are directed slightly to the left, the axes OA and O′A′ are parallel without there being any extra tension upon the muscles. On moving to "eyes front," the axes OB and O′B′ are still parallel, but are maintained so by an effort of the weak external rectus of O′, which has had to pull the eye through the angle A′O′B′, while the strong internal rectus of O has no difficulty in carrying it through the angle AOB. Hence, while O is maintained in its position there is a constant tendency of the axis O′B′ to fall into O′C′, producing homonymous diplopia and parallax. As the eyes

* In the statement of these hypotheses, abduction does not necessarily mean absolute abducting power, but rather the net capacity of the eye for turning out—*i. e.*, the maximum power of the external rectus minus the minimum power of the internal rectus. Accepting this definition of abduction with the complementary one of adduction, all the above hypotheses may be reduced to the general statement that in the case under consideration both the abduction and the adduction of the right eye are below the normal, while the abduction and the adduction of the left are in excess.

are carried still further to the right, this tendency becomes more and more marked, and in extreme "eyes right" the axes OD and O′D′ make a distinct angle with each other, producing well-marked and invincible homonymous di-



plopia. On the other hand, as the eyes sweep to the left, the strongly preponderant abduction of O carries the eye readily through the angle AOE, while, the adducting power of O′ being comparatively feeble, this eye is carried through the less angle A′O′E′, and a condition of divergence of the axes with crossed diplopia and parallax exists. The indication for operation in such case will be tenotomy of the right internal rectus, in order to prevent the tendency of O′ to look toward A′ and in order to give the eye with feebler muscular action (and especially with feebler abducting power) the easier task to perform. The operation being performed in such a way that O′ now looks straight forward to B′, we would have now in "eyes front" a slight tendency to exophoria (readily overcome by the strong adduction of

O), and, as the relative abducting power of O′ is increased by the weakening of its internal rectus, a much smaller tendency to homonymous diplopia and parallax on rotating the eye to the right.

A number of other cases might be cited in which this test has shown itself useful in determining the dynamic relations of the two eyes and furnishing indications for treatment. It is sufficient to say that in my own practice I have found it a serviceable procedure and one which I would never omit when making an examination for heterophoria.

The corresponding test for the dynamic condition of the superior and the inferior recti—*i. e.*, by placing the eyes in the position "eyes up" and "eyes down"—may be employed, but is difficult of application and is usually conducted only with the visual axes in convergence. The ordinary excursion-test ("eyes left" and "eyes right") can likewise be employed with the visual axes convergent.

The recording of the results obtained by these various tests is much simplified by the use of the following abbreviations, which I have lately employed and have found of advantage as saving both time and space and as rendering it easy to exhibit in tabular form, suitable for ready comparison, the records of the examinations from day to day. Many of these abbreviations are already in use and are only given here for the sake of completeness; others have been used by Dr. Stevens and other investigators in this special field; while others still are my own invention, designed to represent the new terms introduced in this paper.

Table of Abbreviations.

Ab.—abduction.
Acc.—accommodation.
Ad.—adduction.
As.—astigmatism.
As. C.—astigmatism corrected.
As. h.—hypermetropic astigmatism.
As. m.—myopic astigmatism.
As. h. m.—mixed astigmatism with predominating hypermetropia.

As. m. h.—mixed astigmatism with predominating myopia.

At.—atropine, or under atropine.

b.—base.

b. d.—base down.

b. i.—base in.

b. o.—base out.

b. u.—base up.

C.—corrected, correction, or with correction.

Conv., Cv.—convergence.

D.—dioptre.

D. or Di.—diplopia.

Div.—divergence.

D′—diplopia in accommodation.

D″—diplopia with the red glass.

D‖—homonymous diplopia.

DX—crossed diplopia.

D. v.—vertical diplopia.

D. L.—left diplopia; vertical diplopia with the image seen by left eye below.

D. R.—right diplopia; vertical diplopia with image seen by right eye below.

E.—eye.

E. d.—eyes down; position (of deorsumversion) in which visual axes are parallel and both directed down.

E. d′—eyes down in convergence; position in which visual axes converge and are both directed down.

E. f.—eyes front; position in which visual axes are parallel and both directed horizontally forward.

E. f′—eyes front in convergence; position in which visual axes converge and are directed horizontally forward.

E. l.—eyes left; position (of sinistroversion) in which visual axes are parallel and both directed to the left.

E. l′—eyes left in convergence; position in which visual axes converge and are both directed to the left.

E. r.—eyes right; position (of dextroversion) in which visual axes are parallel and are both directed to the right.

E. r′—eyes right in convergence; position in which visual axes converge and are both directed to the right.

E. u.—eyes up; position (of sursumversion) in which visual axes are parallel and are both directed up.

E. u′—eyes up in convergence; position in which visual axes converge and are both directed up.

Exc.—excursion.

Exc. T.—excursion test.

Exc. T′—excursion test in accommodation.

H.—hyperphoria.*

H′—hyperphoria in accommodation.

H. C.—hyperphoria corrected or correction of hyperphoria.

Hm.—hypermetropia.

* Symbol used by Dr. G. T. Stevens.

Hm. C.—hypermetropia corrected or hypermetropia-correction.
Ins.—insufficiency.
Ins′—insufficiency in accommodation.
L.—left.
L. E.—left eye.
L. H.—left hyperphoria.*
M.—myopia.
M. C.—myopia corrected, or myopia-correction.
n.—normal.
Op.—ophthalmoscope.
P.—parallax.
p.—prism; near point.
P. lat.—lateral parallax.
P. L.—left parallax; image moves down when left eye is uncovered.
P. R.—right parallax; image moves down when right eye is uncovered.
P. v.—vertical parallax.
P.X—crossed parallax.
P‖—homonymous parallax.
R.—right.
r.—far point.
R. E.—right eye.
Rf.—refraction.
Rf. C.—refraction-correction, or with refraction corrected.
R. g.—red glass.
R. H.—right hyperphoria.*
S—esophoria.†
S′—esophoria in accommodation.
Sc.—behind screen eyes move.
Sd.—sursumduction.
Sd. L.—left sursumduction.
Sd. R.—right sursumduction.
T.—tension.
T. n.—normal tension.
Ten.—tenotomy.
Unc.—uncorrected.
V.—vision.
V. M.—monocular vision.
V. S.—single vision.
V. S′—single vision in convergence.
VV.—binocular vision.
v.—vertical.
X—crossed; exophoria.†
X′—exophoria in accommodation.
‖—homonymous.
<—less than; after a number, denotes an indefinite amount more than this number.*
<<—growing steadily less than.
>—more than; after a number, denotes an indefinite amount less this number.
>>—growing steadily greater than.
+—before a number or symbol, denotes positive; after a number, denotes this number plus a fraction less than one.*
−—before a number or symbol, denotes negative; after a number, denotes this number minus a fraction less than one.*
∼—indefinite.

* Symbol used by Dr. G. T. Stevens.
† Suggested by Dr. A. L. Ranney.

The use of these abbreviations is illustrated by the tabular excerpt from my note-books, given on page 19, describing a case which I was permitted to examine through the courtesy of Dr. A. C. Palmer, of Norfolk, Va.

I lay some stress upon the form here employed, because it exhibits the proper order in which the tests should be made. In the columns headed "E. f." we have the record of the tests made in the "eyes-front" position, or that in which the eyes are in a state of equilibrium and in a condition least removed from the natural. The first column, headed "D., &c.," gives the result of an examination made without introducing any artificial element other than that due to the interposition of a red glass. The second and third columns show the record of the parallax and screen tests which are made simultaneously, and which, as before remarked, are to be performed before the prismatic tests for insufficiency. The latter are recorded in the fourth and fifth columns, the test for hyperphoria being made first and that for lateral insufficiency afterward, according to the principles laid down by Dr. Stevens. After these static tests have been performed there can be made, if desired, the tests with the axes in convergence. These are recorded under the heading "E. f'," the column "D' &c." noting the existence of diplopia or parallax on convergence, and the next column the degree of insufficiency and hyperphoria in accommodation. Then the excursion test is made and the result recorded in the column "E. r. and E. l.," and, if desired, the same test can be made with the axes in convergence, the record being placed in the column "Er' and El'." Last of all are placed the columns "Ab.," "Ad.," and "Sd.," in which the prismatic tests for the abduction, adduction, and sursumduction are entered. For the reasons before given, these last tests should be made after all the others.

Without going into a detail of explanation of all the en-

Date.	Ef.					Ef′.		ExcT.		ExcT′.	Ab.	Ad.	Sd. R L.	Remarks and treatment.
	D &c.	Sc.	P	H	Ins.	D′&c.	Ins′ & H′.	Er.	El.					
May 24.			‖; no v.	0 or R$\frac{1}{3}$.	X = 0-1°.		X′.	D″ ‖.	D″ ‖.		5°	23°		All tests Rf. Unc.
May 28.			X & R*. ‖ & R†.	R, 1°.	X, 1°-.			D″ ‖ & R.	D″ ‖ & R.		3°			*Rf. Unc. †Rf. C.
May 29.	D″X & R	O	‖ & R.	R, 1°.	X, $\frac{1}{2}$°.		H′ = 0 or R.	In both D″X << Ef, and finally SV.			4°* 6°†		1°, 1°	*Rf. Unc. †Rf. C.
June 7.	D″X*‡ D″ = 0 or tendency to D″‖†.		‖ & R‡.	R† trace.	S = 1°‡. S = 0-1°†.			In extreme position, D″ .			6°†			* with H. C.(= R. 1°). †Rf. C. ‡Rf. Unc. To use temporarily p. 1° b. d. R. E.

tries, it will be sufficient to amplify one bearing the date of May 29th. Here the record shows that with the red glass there was crossed and right diplopia—that is, the image perceived by the right eye was below and to the left. No movements of the eyes were detected behind the screen, but the patient exhibited a homonymous and right parallax—that is, on removing the screen from the right eye, the candle-image moved down and to the right. The prismatic tests showed a right hyperphoria of 1° and an exophoria of ½°. In accommodation there was either no hyperphoria or a tendency to right hyperphoria. On performing the excursion test, both in the position of "eyes right" and "eyes left," the crossed diplopia with the red glass became progressively less, and finally changed to single vision. The abduction was 4° with the refraction uncorrected and 6° with the refraction corrected, and the right and left sursumduction were each 1°.

It will be seen that by employing a tabular form of this sort, which a physician can read at a glance, the results of a long series of observations and trials can be very speedily recorded and most succinctly displayed.

Note.—Owing to the lack of distinctive terms to express the different ideas involved, the nomenclature of the motor conditions of the eye is somewhat confused. Abduction, for example, is used to denote (*a*) the absolute power of movement inherent in the external rectus (*i. e.*, the total capacity for movement outward of the eye without any deduction for the opposing tension of the internal rectus), (*b*) the net actual capacity for movement outward of one eye (*i. e.*, the difference between the maximum power of movement of the external rectus and the minimum power of movement of the internal rectus), and (*c*) the net amount of outward movement of both eyes conjoined (*i. e.*, the degree by which they can diverge from each other). The last is properly designated by the term *diverging capacity* or *divergence* [G. T. Stevens]. For the second the word *abduction* may properly be retained. For the first there is no word existing, and therefore I would propose as its equivalent the term *exokinesis*. The corresponding terms for the inward movements of the

eye are *esokinesis*, *adduction*, and *convergence ;* for the upward movements, *anokinesis*, *sursumvergence*, and *sursumduction ;* and for the downward movements, *catokinesis*, *deorsumvergence*, and *deorsumduction*. Or, arranging in tabular form:

Capacity for movement.	In.	Out.	Up.	Down.
Absolute capacity of a single eye, supposing there to be no opposing tension.	Eso-kinesis.	Exo-kinesis.	Ano-kinesis.	Cato-kinesis.
Net capacity of single eye.	Adduc-tion.	Abduc-tion.	Sursum-duction.	Deorsum-duction.*
Capacity of separation of the eyes from each other.	Conver-gence.	Diver-gence.	Sursum-vergence.	Deorsum-vergence.*

There also seems to be required some word to express the general condition in which the various muscular tensions and movements are so adjusted that the visual axes are directed without difficulty at any desired point, or are maintained in parallelism during distant vision; the condition, in other words, in which the individual movements of each eye are properly performed and are properly co-ordinated with the movements of its fellow. This state of perfect dynamic adjustment, which corresponds to the ideal static condition of orthophoria, is appropriately designated as *isokinesis*. The contrary condition, in which one eye fails to move with the other so that there is difficulty in directing one or both visual axes at an object, may be termed *anisokinesis*.

* In practice, the terms deorsumduction and deorsumvergence are not employed, it being found more convenient to speak of the conditions opposed to right sursumduction and right sursumvergence as left sursumduction and left sursumvergence rather than as right deorsumduction and right deorsumvergence.

REASONS WHY

Physicians Should Subscribe

FOR

The New York Medical Journal,

EDITED BY FRANK P. FOSTER, M. D.,

Published by D. APPLETON & CO., 1, 3, & 5 Bond St.

1. **BECAUSE**: It is the *LEADING JOURNAL* of America, and contains more reading-matter than any other journal of its class.
2. **BECAUSE**: It is the exponent of the most advanced scientific medical thought.
3. **BECAUSE**: Its contributors are among the most learned medical men of this country.
4. **BECAUSE**: Its "Original Articles" are the results of scientific observation and research, and are of infinite practical value to the general practitioner.
5. **BECAUSE**: The "Reports on the Progress of Medicine," which are published from time to time, contain the most recent discoveries in the various departments of medicine, and are written by practitioners especially qualified for the purpose.
6. **BECAUSE**: The column devoted in each number to "Therapeutical Notes" contains a *résumé* of the practical application of the most recent therapeutic novelties.
7. **BECAUSE**: The Society Proceedings, of which each number contains one or more, are reports of the practical experience of prominent physicians who thus give to the profession the results of certain modes of treatment in given cases.
8. **BECAUSE**: The Editorial Columns are controlled only by the desire to promote the welfare, honor, and advancement of the science of medicine, as viewed from a standpoint looking to the best interests of the profession.
9. **BECAUSE**: Nothing is admitted to its columns that has not some bearing on medicine, or is not possessed of some practical value.
10. **BECAUSE**: It is published solely in the interests of medicine, and for the upholding of the elevated position occupied by the profession of America.

Subscription Price, $5.00 per Annum. Volumes begin in January and July.